India, an emerging high tech giant

But does she have feet of clay ?

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Abstract

India's economy has been performing well since the onset of reforms in 1991: growth rate in real GDP averaged around 5.7 per cent per annum during the 1990s and it has now increased to 6.9 per cent per annum during the period since 2000. Estimates on total factor productivity show that this increased growth is accompanied by improvements in the efficiency of resource use. On many indicators of innovation, the country is doing quite well not only compared to its past performance, but compared to the other star-performer China as well. An interesting aspect of this growth performance is the growth of high technology industries such as IT, Biotechnology and the pharmaceutical industries. India has also become a major recipient of R&D outsourcing deals from especially western MNCs. While this is all very fine, questions are now raised as to whether this high growth in technology and innovation can be sustained. This is because there is now strong feeling that the country is experiencing shortages in skilled manpower. Further questions have been raised about its quality as well. Fortunately there is appreciation of this problem in government policy circles and the government has tried to respond to this problem of quantity and quality of technical manpower in various ways. If she is successful in getting the numbers and quality right, the country will be on a firm footing to become an innovation power house in the future.

Outline

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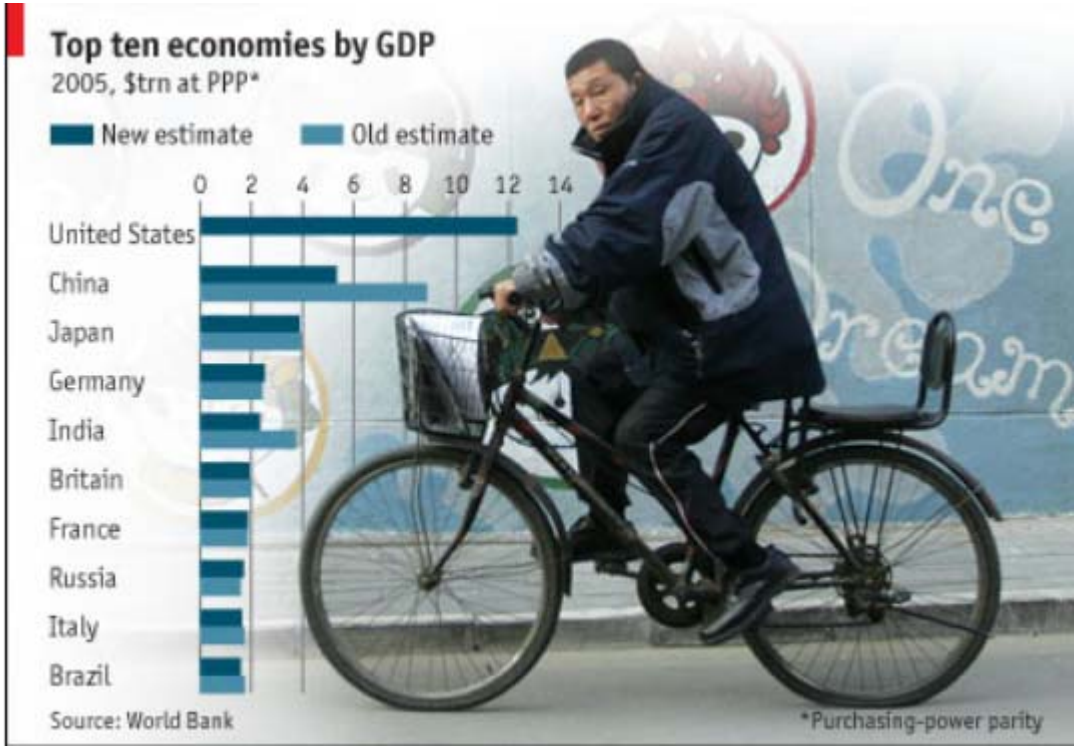
- **Conclusions**

India has emerged as the fifth largest economy in the world

(Based on the level of its GDP in PPP terms in 2005)



Improvements in overall performance of India's economy, 1990-91 through 2007-08 (in per cent)

Sector	1990-91 to 1999-2000 (Average)
1	2
1. Agriculture and Allied Activities	3.2
1.1 Agriculture	3.3
2. Industry	5.7
2.1 Mining and Quarrying	4.8
2.2 Manufacturing	5.6
2.3 Electricity, Gas and Water Supply	7.3
3. Services	7.1
3.1 Trade, Hotels, Restaurants, Transport Storage and Communication	7.5
3.2 Financing, Insurance, Real Estate and Business Services	8.1
3.3 Community, Social and Personal Services	6.5
3.4 Construction	5.6
4. Real GDP at Factor Cost	5.7

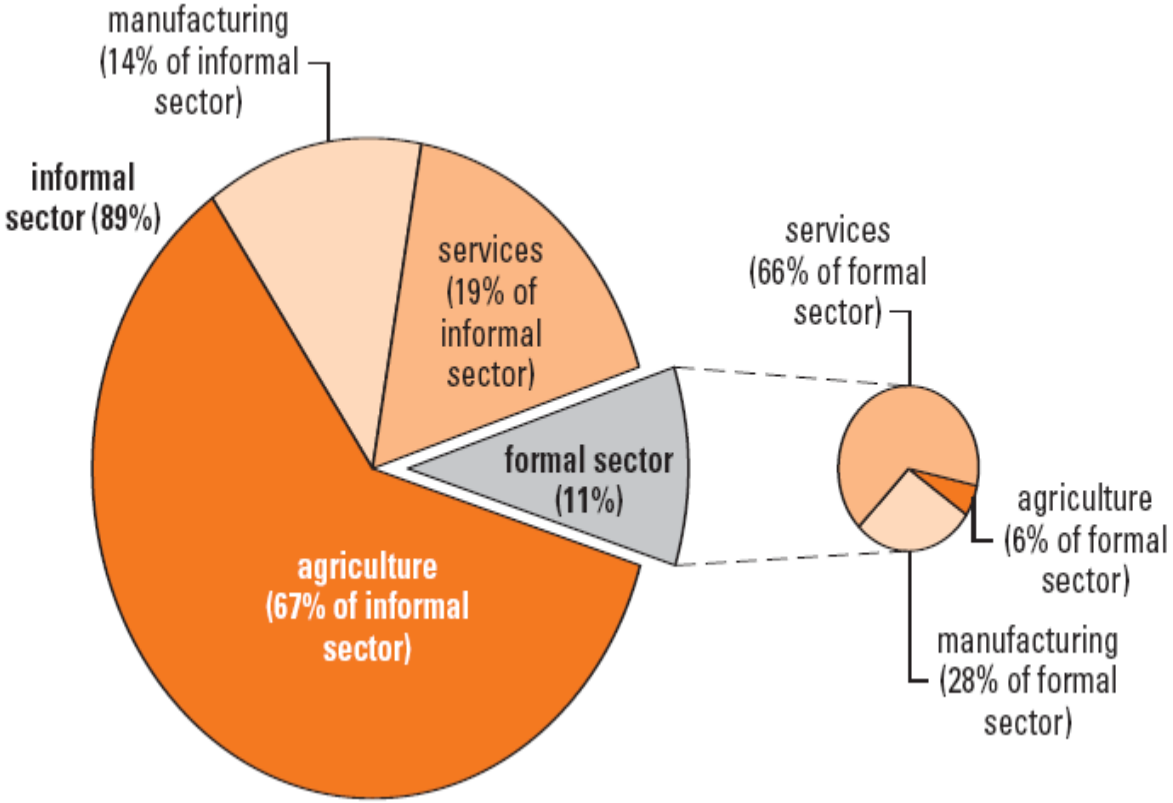
Sector	2000-01 to 2007-08 (Average)	2005-06	2006-07*	2007-08#
1	2	3	4	5
1. Agriculture and Allied Activities	**2.6 (20.8)**	**5.9 (19.6)**	**3.8 (18.5)**	**2.6 (17.5)**
2. Industry	**7.2 (19.6)**	**8.0 (19.4)**	**10.6 (19.5)**	**8.6 (19.5)**
2.1 Mining and Quarrying	4.8	4.9	5.7	3.4
2.2 Manufacturing	7.9	9.0	12.0	9.4
2.3 Electricity, Gas and Water Supply	5.0	4.7	6.0	7.8
3. Services	**8.9 (59.6)**	**11.0 (61.1)**	**11.2 (61.9)**	**10.6 (63.0)**
3.1 Trade, Hotels, Restaurants, Transport, Storage and Communication	10.3	11.5	11.8	12.1
3.2 Financing, Insurance, Real Estate and Business Services	8.8	11.4	13.9	11.7
3.3 Community, Social and Personal services	5.8	7.2	6.9	7.0
3.4 Construction	10.5	16.5	12.0	9.6
4. Real GDP at Factor Cost	**7.2**	**9.4**	**9.6**	**8.7**
Memo:				
a) Real GDP at factor cost		26,12,847	28,64,310	31,14,452
b) GDP at current market prices		35,80,344	41,45,810	46,93,602

@: Provisional Estimates. * : Quick Estimates. # : Revised Estimates. n.a. : Not Available.

Note : 1. Figures in parentheses denote percentage shares in real GDP.
2. Q1: First Quarter (April-June); Q2: Second Quarter (July-September); Q3: Third Quarter (October-December); and Q4: Fourth Quarter (January-March).

Source : National Accounts Statistics, Central Statistical Organisation.

Dualistic structure of India's economy, c2006



Innovation input and output: India compared with BRIC, 2003 and 2004

Indicator	Brazil	Russian Fed.	India	China
Researchers in R&D, 2003	59,838	477,647	117,528	926,252
R&D researchers per million population, 2004	344	3,319	119	708
Spending on R&D ($ billions), 2004	5.9	6.8	5.9	27.8
Spending on R&D (percentage of GDP), 2004	0.98	1.17	0.85	1.44
Scientific and technical journal articles, 2003	8,684	15,782	12,774	29,186
R&D spending ($ thousands) per scientific and technical article[a]	682	431	460	953
Scientific and technical journal articles per million population, 2003	47.9	109.1	12.0	22.7
Patents granted by U.S. Patent Office, 2004	161	173	376	597
R&D spending ($ millions) per patent granted[a]	376.7	39.3	15.6	46.6

A very interesting recent example of Indian Innovation

World's first cheapest car priced at US $ 2500 developed by TATA Motors

Is India becoming more innovative ?

Trends in India's overall investments in R&D

	Gross Expenditure on R&D (Rs in Millions)				
	At Current Prices	At Constant Prices (Base Year:1993-94)	Nominal growth rate (%)	Real Growth rate	GERD to GDP ratio
1980-81	7605.2	23421.6			
1981-82	9407.3	26297.1	23.70	12.28	0.58
1982-83	12060.3	31175.4	28.20	18.55	
1983-84	13811	32786.4	14.52	5.17	
1984-85	17815.5	39386.3	29.00	20.13	
1985-86	20687.8	42611.4	16.12	8.19	0.83
1986-87	24354	46868.1	17.72	9.99	0.88
1987-88	28530.7	50202.3	17.15	7.11	0.91
1988-89	33472.6	54345.1	17.32	8.25	0.9
1989-90	37257.4	55858	11.31	2.78	0.86
1990-91	39741.7	53972.4	6.67	-3.38	0.78
1991-92	45128.1	53867.9	13.55	-0.19	0.77
1992-93	50046	54947.8	10.90	2.00	0.79
1993-94	60730.2	60730.2	21.35	10.52	0.78
1994-95	66224.4	60425.3	9.05	-0.50	0.70
1995-96	74838.8	62634.4	13.01	3.66	0.70
1996-97	89136.1	69497	19.10	10.96	0.72
1997-98	106113.4	77507.6	19.05	11.53	0.76
1998-99	124731.7	84362.6	17.55	8.84	0.78
1999-00	143976	93751	15.43	11.13	0.82
2000-01	161988	101962.8	12.51	8.76	0.85
2001-02	170381.5	103720.9	5.18	1.72	0.82
2002-03	180001.6	105225.7	5.65	1.45	0.80
2003-04*	197269.9	111989.3	9.59	6.43	0.78
Average rate of growth (pre reform)			18.17	8.91	0.81
Average rate of growth (post reform)			13.22	6.57	0.77

Sector-wide performance of R&D in India (percentage shares)

	Government	Industry	Higher Education
1970-71	89.55	10.45	
1975-76	88.13	11.87	
1980-81	84.13	15.87	
1985-86	87.82	12.18	
1990-91	86.16	13.84	
1995-96	78.26	21.74	
1998-99	75.79	21.17	3.04
1999-00	77.21	18.46	4.33
2000-01	77.94	18.05	4.02
2001-02	76.48	19.33	4.20
2002-03	75.56	20.27	4.17
2003-04*	75.44	20.05	4.51
2004-05*	73.92	19.81	4.88

Growing privatisation of industrial R&D (Rs in Millions)

	Government			Private Sector enterprises	Industrial R & D	Share of Private Sector In Total Industrial Development
	Public Sector Enterprises	Govt.Research Institutions	Total government			
1985-86	1986.18	1622.7	3608.88	2519.44	6128.32	41.11
1986-87	2356.99	1723.36	4080.35	2916.33	6996.68	41.68
1987-88	2884.66	1851.29	4735.95	3102.67	7838.62	39.58
1988-89	3421.24	2093.28	5514.52	4176.25	9690.77	43.10
1989-90	4129.01	2395.21	6524.22	4905.94	11430.16	42.92
1990-91	4145.33	2491.88	6637.21	5499.81	12137.02	45.31
1991-92	4843.88	2745.50	7589.38	6369.44	13958.82	45.63
1992-93	5139.50	2993.65	8133.15	8362.47	16495.62	50.70
1993-94	5428.11	NA	NA	9825.37		
1994-95	4146.09	3564.00	7710.09	13188.70	20898.79	63.11
1995-96	4275.76	4116.99	8392.75	16270.69	24663.44	65.97
1996-97	5360.52	4440.00	9800.52	23307.50	33108.02	70.40
1997-98	5392.40	5641.30	11033.70	24382.50	35416.20	68.85
1998-99	6738.70	7133.20	13871.90	21766.10	35638.00	61.08
1999-00	7576.30	7808.82	15385.12	21781.10	37166.22	58.60
2000-01	8428.80	8641.20	17070.00	24114.00	41184.00	58.55
2001-02	7673.70	8922.60	16596.30	27874.80	44471.10	62.68
2002-03	8069.50	9512.50	17602.00	30649.30	48251.30	63.52

Industry-wide distribution of Industrial R&D

(cumulative share in per cent 1998-99 through 2002-03)

Industry	Share
Metallurgiical Industries	4.21
Fuels	6.12
Boilers & steam Generating Plants	0.01
Prime Movers	0.09
Electricals & Electronic Equipment	**8.94**
Telecommunications	3.75
Transportation	**15.16**
Industrial Machinery	1.84
Machine Tools	0.75
Agricultural Machinery	1.33
Earth Moving Machinery	0.10
Misc. Mechanical Engineering Industries	1.22
Commercial Offices, Household Equipment	0.15
Medical & Surgical Appliances	0.04
Industrial Instruments	0.74
Scientific Instruments	0.09
Math. Surveying & Drawing Instrument	0.00
Fertilisers	0.81
Chemicals(other than Fertilisers)	**8.35**
Photographic Raw Film & Paper	0.05
Dye-Stuffs	0.26
Drugs & Pharmaceuticals	**19.30**
Textiles(Dyed, Printed, Processed)	1.21
Paper & Pulp	0.34
Sugar	0.92
Fermentation Industries	0.05
Food Processing Industries	1.39
Vegetable Oil & Vanaspathi	0.09
Soaps, Cosmetics &Toilet Preparations	2.37
Rubber Goods	0.95
Leather, Leather Goods and Pickers	0.21
Glue and Gelatin	0.05
Glass	0.21
Ceramics	0.25
Cement & Gypsum Products	0.60
Timber Products	0.01
Defence Industries	**8.32**
Information Technology	**4.69**
Biotechnology	1.59
Consultancy Services	1.05
Miscellaneous Industries	2.38

Trends in US Patenting by Indian Inventors, Pre 1994-2007

(Number of patents)

	Pre 1994	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Compound rate of growth
China, P.Rep	431	48	62	46	62	72	90	119	195	269	297	404	402	661	772	23.82
South Africa	2390	101	123	111	101	115	110	111	120	113	112	100	87	109	82	-1.59
China, Hong Kong	702	57	86	88	81	160	155	179	237	233	276	311	283	308	338	14.67
India	428	27	37	35	47	85	112	131	178	249	342	363	384	481	546	26.02
Russian Federation	3	38	98	116	111	189	181	183	234	200	203	169	148	172	188	13.09
Brazil	752	60	63	63	62	74	91	98	110	96	130	106	77	121	90	3.17

Distribution of US patents according to ownership, 1991-2005

		1991		2000		2005		1991-2005	
	Organisation	No. of Patents	share	No. of Patents	share	No. of Patents	share	No. of Patents	share
1	Foreign	5	29.4118	41	32.54	138	45.2459	503	30.21
	MNCs	5	29.4118	41	32.54	138	45.2459	501	30.09
	Government	0	0.0000		0	0	0	2	0.1201
2	Indian	12	70.5882	85	67.46	167	54.7541	1162	69.79
	GRI & others	3	17.6471	40	31.746	118	38.6885	737	44.264
	IOP	5	29.4118	12	9.5238	12	3.93443	157	9.4294
	Public sector Enterprises	1	5.8824	9	7.1429	6	1.96721	39	2.3423
	Private sector Enterprises	3	17.6471	24	19.048	31	10.1639	229	13.754
	TOTAL	17		126		305		1665	

The top 15 most emphasised patents by Indian inventors, 2002-2006

	Class Title	2002	2003	2004	2005	2006	Total
532	Organic Compounds (includes Classes 532-570)	78	70	65	61	69	343
424	Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	48	72	44	54	70	288
435	Chemistry: Molecular Biology and Microbiology	24	30	19	23	26	122
520	Synthetic Resins or Natural Rubbers (includes Classes 520-528)	8	8	14	11	13	54
327	Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems	4	10	9	9	16	48
341	Coded Data Generation or Conversion	4	6	3	16	17	46
707	DP: Database and File Management or Data Structures (Data Processing)	4	5	13	6	9	37
423	Chemistry of Inorganic Compounds	4	5	13	5	7	34
709	Multicomputer Data Transferring (Electrical Computers and Digital Processing Systems)	1	3	8	12	10	34
370	Multiplex Communications	2	3	6	7	14	32
702	DP: Measuring, Calibrating, or Testing (Data Processing)	0	5	8	10	8	31
326	Electronic Digital Logic Circuitry	1	5	3	7	12	28
717	DP: Software Development, Installation, and Management (Data Processing)	0	3	4	7	13	27
502	Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making	2	9	5	5	5	26
711	Memory (Electrical Computers and Digital Processing Systems)	0	3	2	9	9	23
		180	237	216	242	298	1173

Trends in the number of Triadic patents granted to Indian inventors, 1990-2003

Column	Korea	Brazil	Russia	India	China	South Africa	World
1990	67	11	21	12	12	14	32503
1991	92	6	36	8	13	18	29781
1992	121	13	42	6	16	31	29829
1993	161	20	28	8	15	33	30412
1994	213	12	47	6	16	20	31909
1995	324	13	51	12	19	24	34845
1996	323	15	46	17	21	27	38072
1997	412	27	51	26	40	33	40735
1998	470	26	70	27	41	33	42775
1999	524	25	61	29	72	33	46674
2000	579	27	65	58	87	37	50164
2001	598	32	61	71	128	38	50642
2002	694	32	58	78	144	37	51738
2003	747	35	56	87	177	38	52855

Share of countries in Triadic patent families, 1995 and 2005

Countries	2005	1995	Annual Growth Rate (1995-2005)
India	**0.2**	**0**	**27.6**
China	**0.8**	**0.1**	**36.7**
Korea	6	0.9	25.6
Brazil	0.1	0	14.6
Mexico	0	0	4.9
South Africa	0.1	0.1	3.3
Russian Federation	0.1	0.1	-0.4
Singapore	0.2	0.1	14.6
Chinese Taipei	0.3	0.1	19.7
United Kingdom	3	4.3	0.6
EU 25	28.4	33	2.7
United States	31	34.4	3.1

Overall publication trends: India Vs China

The first metric is number of articles as a function of time. All research articles in the SCI/ SSCI having at least one author with an India address were retrieved for selected years. The same was done for China. The results (leading country first) are: (year/ number of articles):

- 1980: India [10606]; China [692]
- 1985: India [10632]; China [3115]
- 1990: India [11563]; China [7011]
- 1995: India [12602]; China [11402]
- 2000: China [29292]; India [16203]
- 2005: China [72310]; India [25367]

Publication trends in high impact journals, India Vs China

YEAR	JACS INDIA	JACS CHINA	P REV LETT INDIA	P REV LETT CHINA	J BIO CHEM INDIA	J BIO CHEM CHINA
1995	5	2	34	14	9	2
1996	17	5	49	33	13	2
1997	17	11	52	31	17	7
1998	23	12	66	56	10	7
1999	11	13	51	39	23	16
2000	19	35	54	70	17	25
2001	15	49	59	85	42	46
2002	14	45	49	82	31	56
2003	19	89	55	134	60	83
2004	15	99	50	151	54	110
2005	27	142	52	158	44	124
2006	4	22	8	28	2	13

CODE:

JACS=Journal of the American Chemical Society

P REV LETT=Physical Review Letters

J BIO CHEM=Journal of Biological Chemistry

India's Technology Balance of Payments

(Millions of US $)

	Payments	Adjusted Payments	Receipts	Adjusted Receipts	TBoP	Adjusted TBoP
2000	311		54		-257	
2001	236		60		-176	
2002	361		22		-339	
2003	352		23		-329	
2004	444		32		-412	
2005	712	1890	71	1709	-641	-181
2006	729	2514	129	5288	-600	2774

Technology imports to India

(in millions of US $)

	Embodied technology imports	Disembodied rechnology imports	Ratio of Embodied to Disembodied
2000	5972	311	19.20
2001	5246	235	22.32
2002	5883	361	16.30
2003	7405	352	21.04
2004	10390	444	23.40
2005	14475	712	20.33
2006	17590	725	24.26
2007	36057		

Diversification of India's exports: From commodities to services

(Value in Millions of US $)

	Merchandise	Services	Total	Share of services	Software	Share 1	Share 2	Share 3
1990-91	18477	4551	23028	2				
1991-92	18266	5022	23288	2				
1992-93	18869	4730	23599	2				
1993-94	22683	5264	27947	3	325	1.16	6.17	1.43
1994-95	26855	6135	32990	3	489	1.48	7.97	1.82
1995-96	32311	7346	39657	4	747	1.88	10.17	2.31
1996-97	34133	7474	41607	4	1099	2.64	14.70	3.22
1997-98	35680	9429	45109	5	1760	3.90	18.67	4.93
1998-99	34298	13186	47484	6	2626	5.53	19.92	7.66
1999-00	37542	15709	53251	8	4015	7.54	25.56	10.69
2000-01	45452	16268	61720	8	6341	10.27	38.98	13.95
2001-02	44703	17140	61843	8	7556	12.22	44.08	16.90
2002-03	53774	20763	74537	10	9600	12.88	46.24	17.85
2003-04	66285	26868	93153	13	12800	13.74	47.64	19.31
2004-05	85206	43249	128455	21	17700	13.78	40.93	20.77
2005-06	105152	61404	166556	29	23600	14.17	38.43	22.44
2006-07	127090	81330	208420	39	31300	15.02	38.49	24.63
Share 1 : Software exports as a per cent of total exports								
Share 2 : Software exports as a per cent of service exports								
Share 3: Software exports as per cent of total merchandise exports								

India is now the largest exporter of IT services in the World

(Value in billions of US $)

Rank*	Country	2000	2003	2004	2005
1	2	3	4	5	6
1	**India**	**6.3**	**12.8**	**17.7**	**23.6**
2	Ireland	7.5	14.2	18.8	18.7
3	U.K.	4.3	8.2	11.7	10.6
4	Germany	3.8	6.7	8.0	8.1
5	U.S.A.	5.6	6.3	6.8	6.0
6	Israel	4.2	3.7	4.4	4.5
7	Netherlands	1.2	2.9	3.7	3.6
8	Spain	2.0	2.9	3.0	3.6
9	Canada	2.4	2.8	3.1	3.4
10	Belgium	–	2.1	2.4	2.6

* : Ranking is for the year 2005.

Source : Balance of Payments Statistics Yearbook 2006, IMF and Reserve Bank of India.

India’s acquisitions abroad

Indian companies are acquiring international firms in an effort to acquire new markets and maintain its growth momentum, buy cutting-edge technology, develop new product mixes, improve operating margins and efficiencies, and take worldwide competition head-on:

In 2007, for instance

1. **Tata Steel has acquired UK- based Corus for about US$ 8 billion.**
2. **Suzlon Energy Ltd has acquired German firm Repower Systems AG for US$ 1.7 billion.**
3. **Vijay Mallya-led United Spirits has bought Scotch whisky distiller Whyte & Mackay for US$ 1.11 billion**
4. **Tata Power has acquired significant stake in two Indonesian firms, PT Kaltim Prima Coal and PT Arutmin Indonesia, for US$ 1.1 billion.**
5. **Essar Group has acquired Canadian firm Algoma Steel for about US$ 1.55 billion.**
6. **Hindalco has acquired Novelis for US$ 6 billion.**
7. **JSW Steels acquired three US firms, Jindal United Steel Corp, Saw Pipes USA and Jindal Enterprises LLC, for US$ 940 million**.

While pharmaceuticals, IT and energy were the prominent sectors attracting investments by Corporate India, significant Indian investment has also flown into metals, industrial goods, automotive components, beverages, cosmetics, mobile communications, software and financial services

FDI from and to India

(in Millions of US $)

	FDI from India	FDI to India	Ratio
2000-01	829	4031	0.21
2001-02	1490	6130	0.24
2002-03	1892	5095	0.37
2003-04	2076	4322	0.48
2004-05	2309	6052	0.38
2005-06	3150	7722	0.41
2006-07	11888	19531	0.61

Components of outward FDI from India

(US $ Millions)

Period (April-March)	Equity*	Loan	Guarantee Invoked	Total
2003-04	1234.25	260.93	-	1495.18
2004-05	1365.59	402.79	-	1768.38
2005-06	3858.46	1008.10	3.00	4869.56
2006-07	11599.01	1281.07	-	12880.08
2007-08				
April-June	4268.89	425.93		4694.82
July-September	1552.00	285.37		1837.37
October-December	3275.61	306.42		3582.03
April-December, 2007-08	9096.50	1017.72	-	10114.22
April-December, 2006-07	8097.27	876.07	-	8973.34

* : The equity data do not include equity of individuals and banks.

Note : Figures are provisional.

Inflows on account of FDI from India

(Millions of US $)

(US million)

Period	Dividend	Others@	Total
2006-07	21.96	272.75	294.71
2007-08 (April-December)	29.41	307.68	337.09
2006-07 (April-December)	20.15	274.33	294.48

@ : Others include dividend, royalty, licence fee, brand fee, technical know-how fee, repayment of loan, etc.

Note : Figures are provisional.

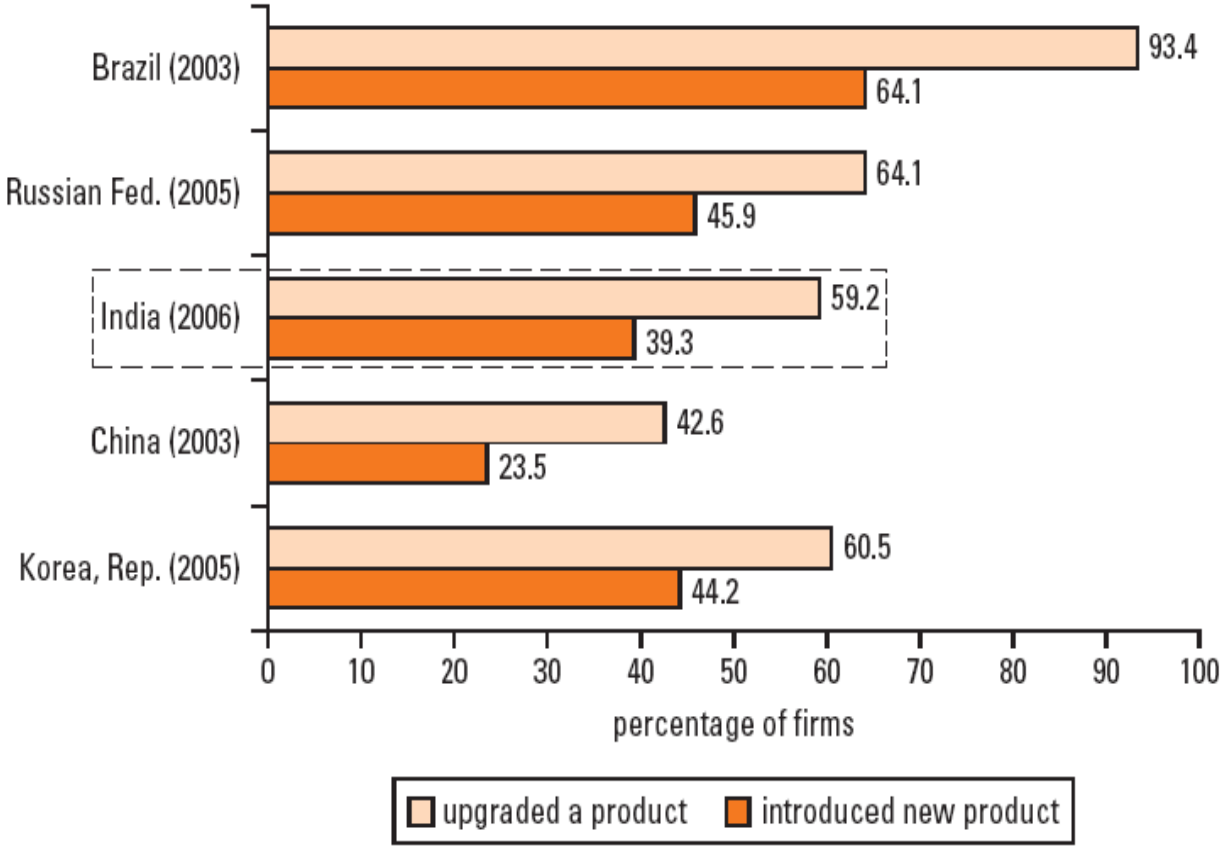
Growing share of high technology industries in India's GDP

	IT			*BT*	*Total new technology-based industrial revenue*	*Share of GDP (%)*
	Hardware	*Software*	*Total IT*			
1999–2000	281	244	525	–	–	–
2000–2001	311	378	689	–	–	–
2001–2002	328	474	801	–	–	–
2002–2003	375	590	970	24 (0.41)*	994	4.30
2003–2004	438	745	1183	35 (0.34)	1218	4.83
2004–2005	498	978	1476	47 (0.31)	1523	5.40

*Figures in parentheses indicate ratios of BT to IT.

Source: Department of Information Technology (2005) and Biospectrum (2005)

New indicators of innovation (Based on World Bank Enterprise Surveys), 2003-06



Source: World Bank Enterprise Surveys.

Some disquieting features of India's innovation system

- The recent growth performance of technology-based industries in India is prompting many commentators to feel that India is transforming itself into a knowledge-based economy;
- The copious supply of technically trained human resource is considered to be one of the most important reasons for this growth performance;
- However, of late, the industry has been complaining of serious shortages in technically trained manpower;
- For instance a recent study (2007) conducted by the Federation of Indian Chambers of Commerce and Industry (FICCI) has revealed that the rapid growth in the globally integrated Indian economy has led to a huge demand for skilled human resources. However, lack of quality in the higher education sector has become a hindrance in filling the gap. The survey, based on a study conducted in 25 sectors, also showed that currently there is a shortage of about 25 per cent skilled manpower in the Engineering sector.

Disquieting features....(continued)

- The recent report of the **National Knowledge Commission on Innovation** too highlights this skill shortage;
- However, the database on science and engineering human resource in the country is not up to date;
- Two related but separate sources of data are available: annual surveys of the stock of science and engineering personnel in the country by the national technical manpower information system (NTMIS) and the biennial surveys of scientists and engineers engaged in R&D by the department of science and technology (NSTMIS); and
- Another disquieting feature is that there is extreme geographic concentration of it in just four states: Maharashtra, Andra Pradesh, Karnataka and Tamil Nadu. Even in these four knowledge generating activities are largely concentrated in the capital cities of Mumbai, Hyderabad, Bangalore and Chennai. Such extreme concentration can have serious regional inequity implications.

Estimated stock of science and engineering personnel in India, 1991-2001

(in thousands at the beginning of the year)

	1991	1996	1998	1999	2000	2001
Engineering Degree Holders	520	753	859	914	970	1024
Engineering Diploma Holders	859	1173	1312	1380	1546	1532
Total Engineering	1379	1926	2171	2293	2516	2556
Science Graduates	2430	3155	3479	3655	3838	4025
Science Post Graduates	482	626	696	731	761	805
Total Science	2912	3781	4175	4386	4599	4830
Total S&E	4291	5707	6346	6679	7114	7386
Ratio of science to engineering 1	2.11	1.96	1.92	1.91	1.83	1.89
Ratio of science to engineering 2	5.60	5.02	4.86	4.80	4.74	4.71

Scientists and engineers engaged in R&D in India

(Full Time Equivalent in Numbers as on April 1, 2000)

Name of Establishment	Personnel engaged Primarily in R&D Activities (1)	Personnel engaged in Auxiliary Activities (2)	Personnel engsged in Administrative Activities (3)	Total (1+2+3)
A. INSTITUTIONAL SECTOR				
Major Scientific Agencies	*33165*	45718	41495	120378
Central Government Ministries/Departments	*7954*	16288	19217	43459
State Governments	*17993*	18156	42949	79098
Total Institutional Secter (A)	*59112*	80162	103661	242935
B. INDUSTRIAL SECTOR				
Public Sector Including Joint Secter	*8767*	2580	2327	13674
Privat Sector	*25957*	7303	6474	39734
Total Industrial Sector	*34724*	9883	8801	53408
Total (A+B)	***93836***	**90045**	**112462**	**296343**

Conclusions

- India is definitely on a higher economic growth path
- There is evidence to show that innovative activities in the industrial sector has shown some significant increases during the post reform process. High tech industries now contribute over 5 per cent of India's GDP;
- The innovative activity is, of course, restricted to a few high tech industries
- There is even some macro evidence to show that the productivity of R&D investments in India is higher than in China, although this proposition requires careful empirical scrutiny before firm conclusions can be reached;

Conclusions (continued)

- This rise in innovative activity is largely contributed by the domestic private sector;
- Integration of India's economy with rest of the world has opened up a number of opportunities which seems to have been capitalised by the private sector industry;
- However continued rise in innovative activity is limited by the availability of good quality scientists and engineers;
- Fortunately the government is aware of this problem and has started initiating a number of steps towards easing the supply of technically trained personnel